Assessment of the relation between methane concentrations and the methane flux of an artificial reference cow

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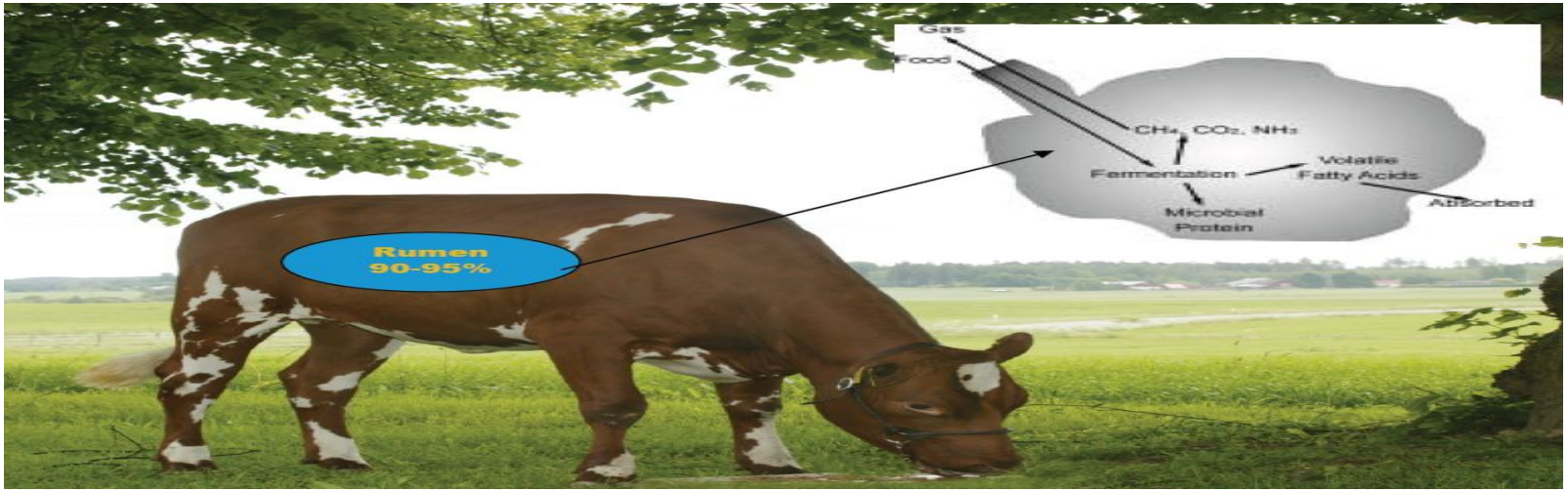
Introduction

- Methane emission from dairy cows:
  - 300 g/day
  - 15% global methane budget
  - 90~95% through nose and mouth
  - 6~10% loss of gross energy intake (Blaxter and Clappterton, 1965; Yan et al., 2010)



Introduction

- Mitigation strategies
  - Nutritional & Management
  - Genetic

- How to **assess** effects?

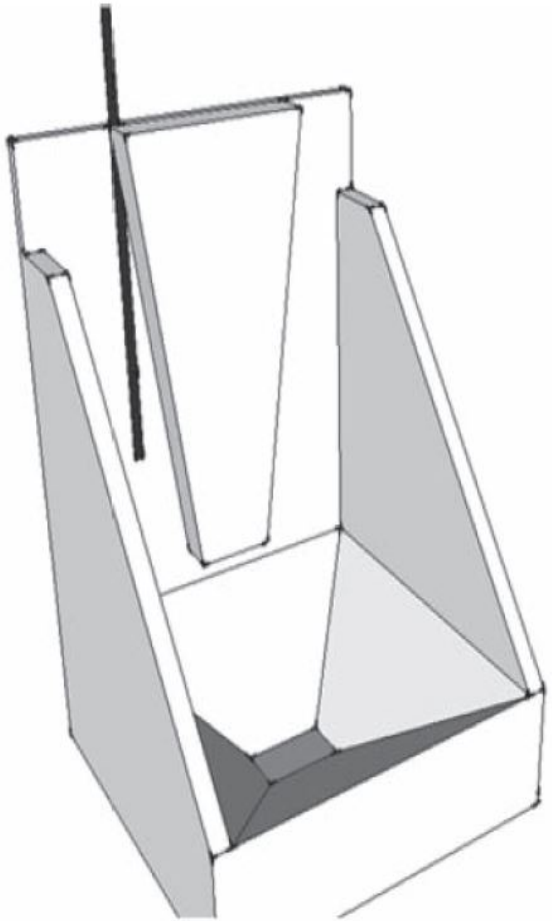
- Lack of suitable techniques for
  - **individual** CH4 measurement from
  - **large number** of cows

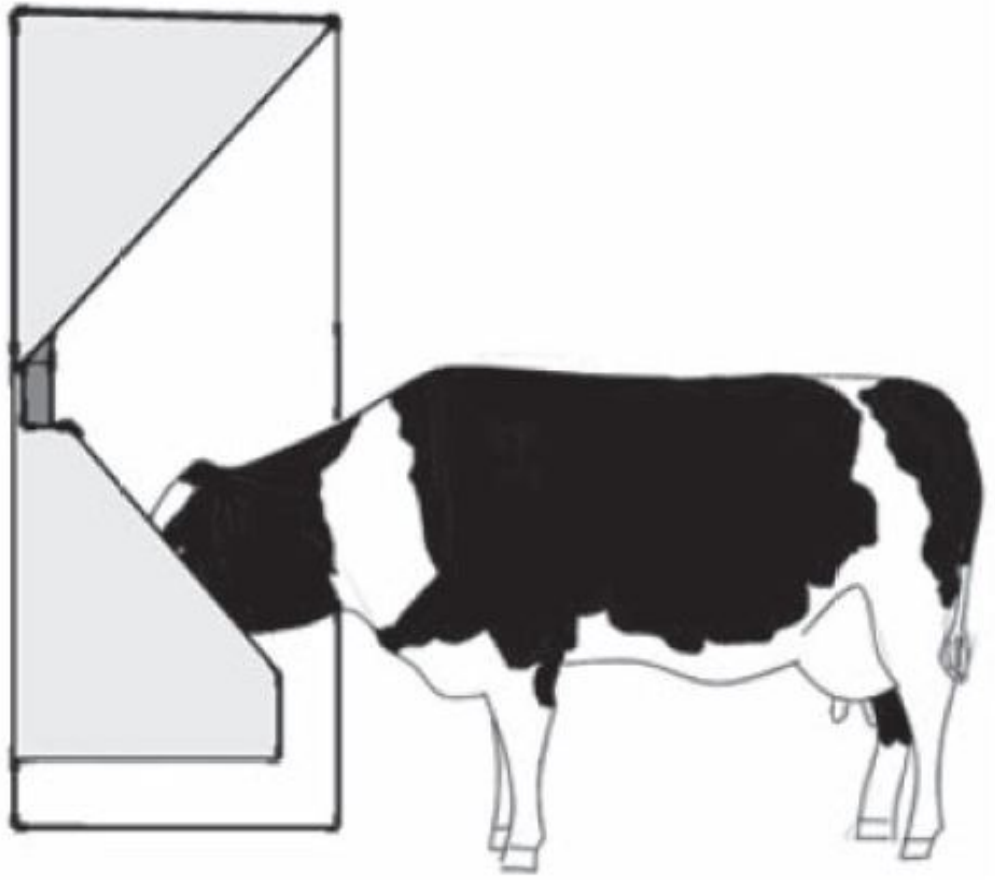
Introduction

- Direct methane flux methods:
  - Respiration chamber
  - Tracer Technique (SF_6)

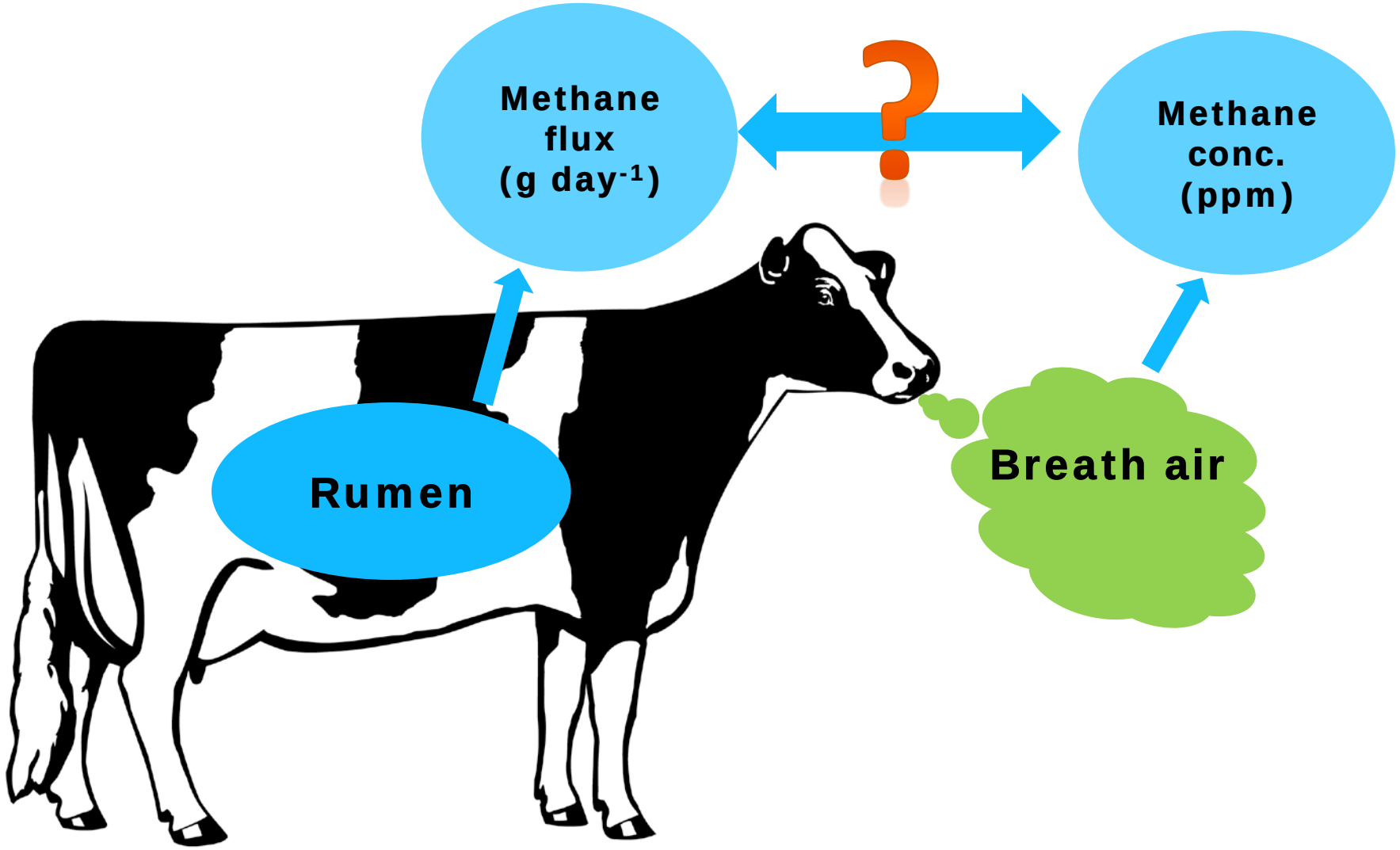
- Indirect methane concentration method:
  - Breath methane measurement method (Garnsworthy et al., 2012; Lassen et al., 2012)

Introduction

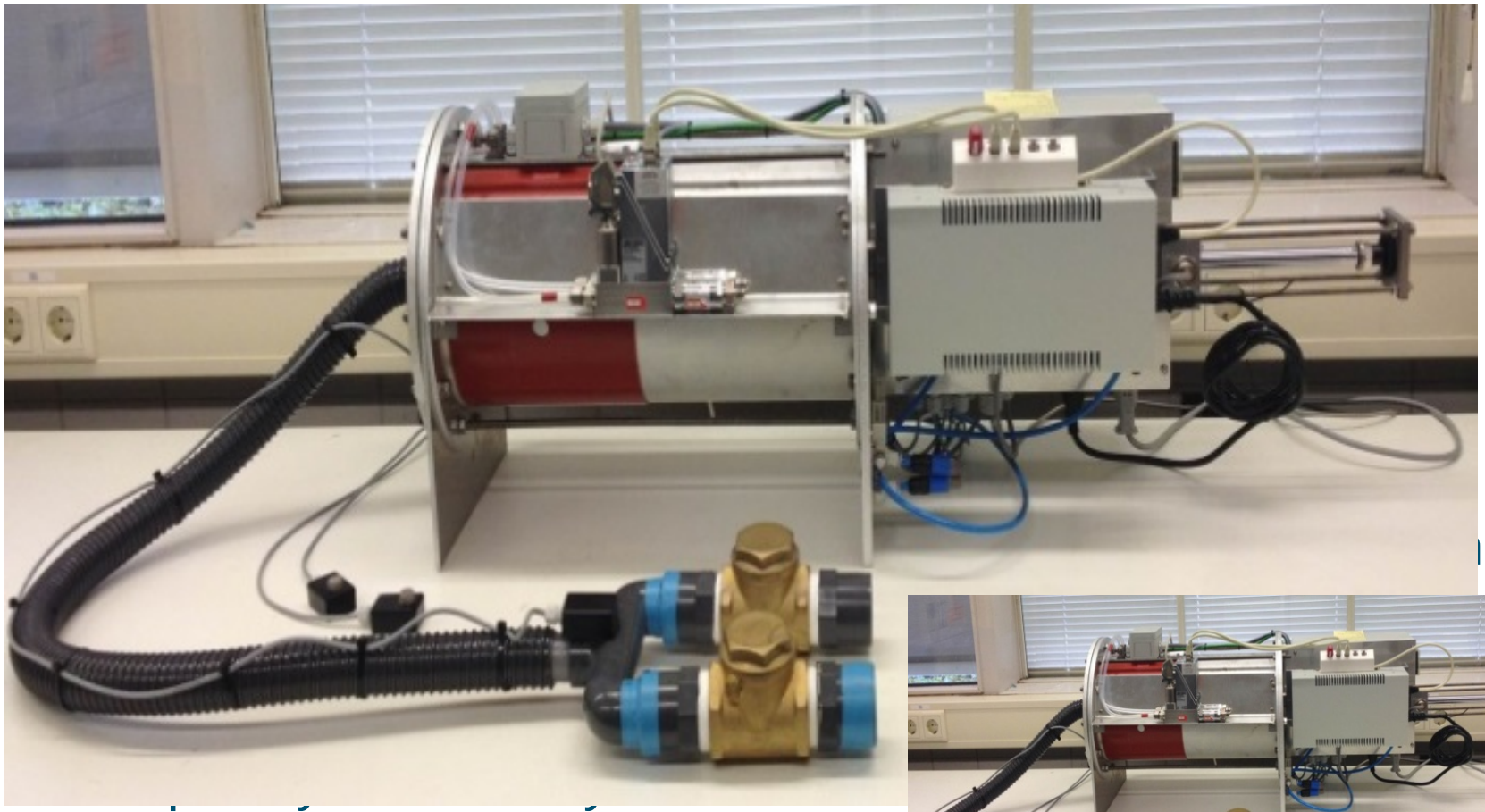




Objective



Material and methods



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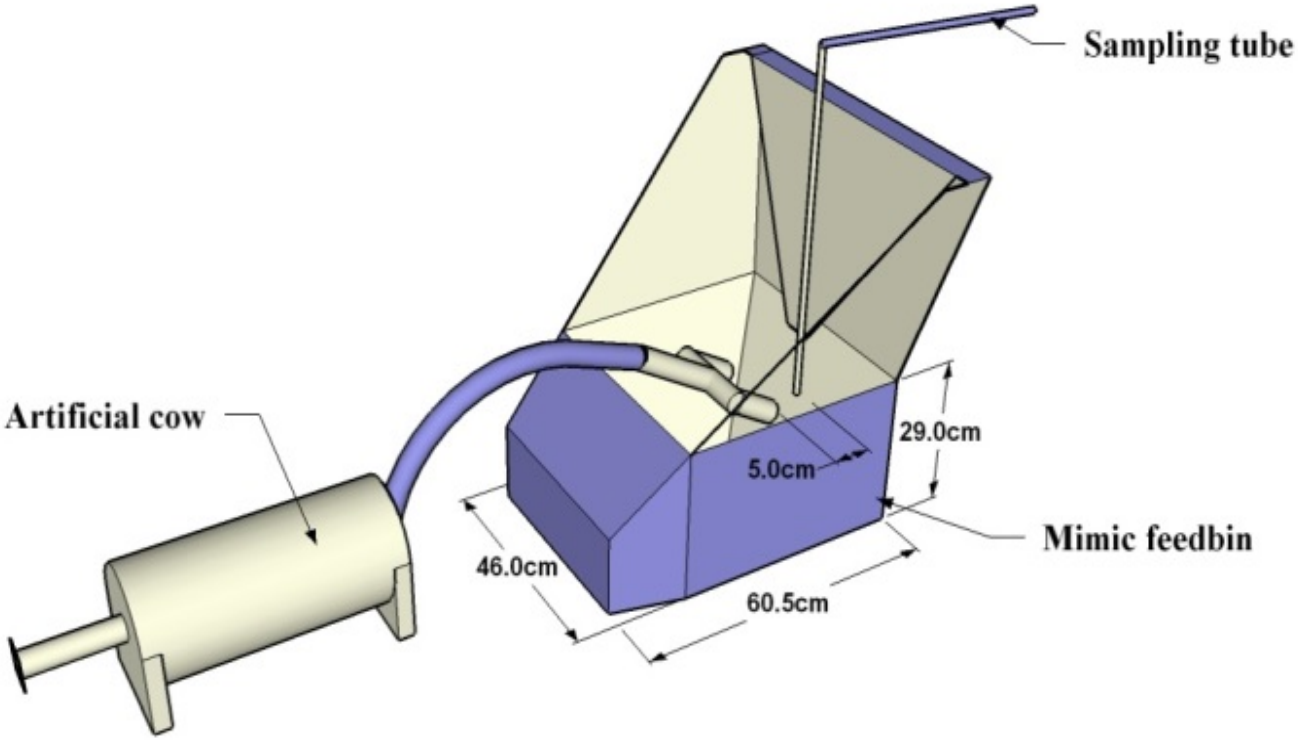
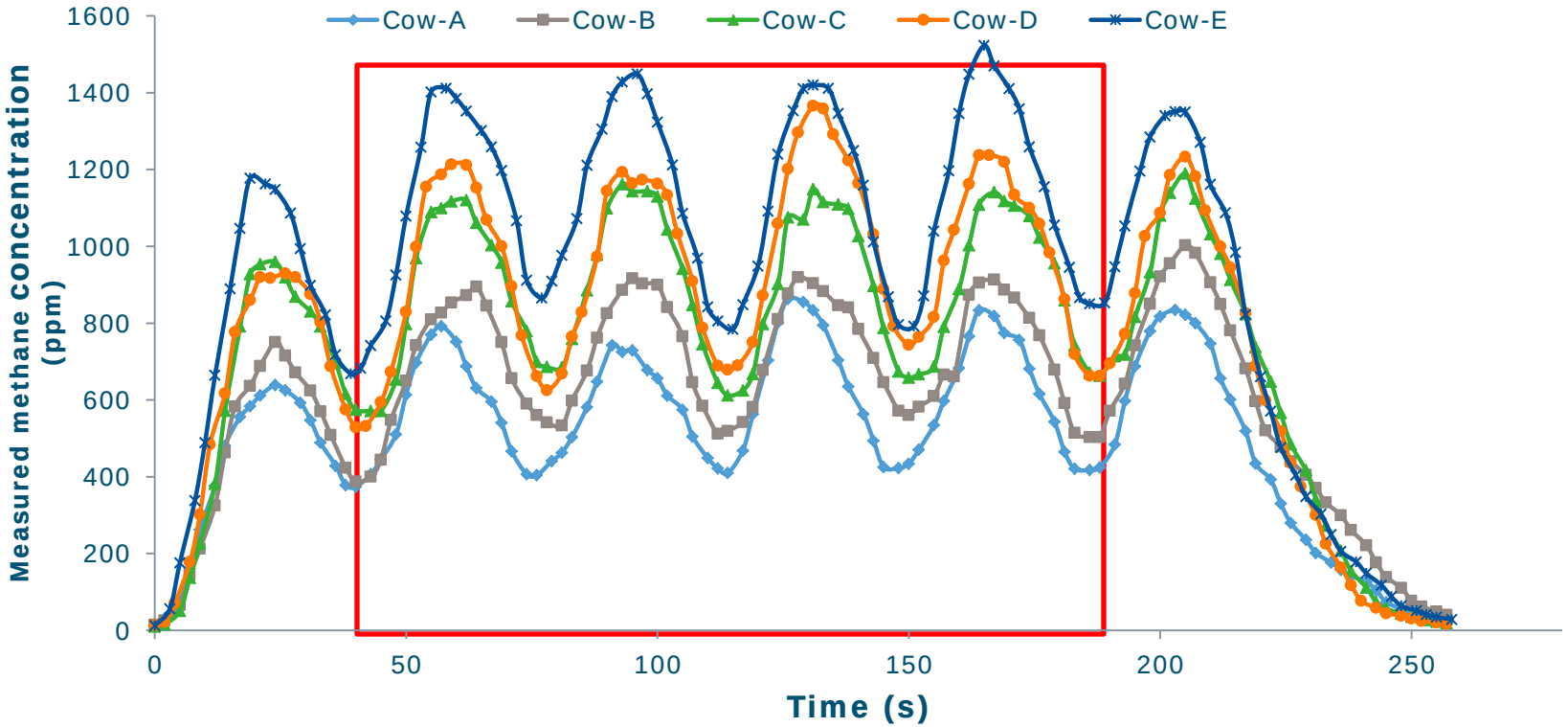


Results and discussion

- Measured methane concentration pattern



- The first and last fluctuation were excluded

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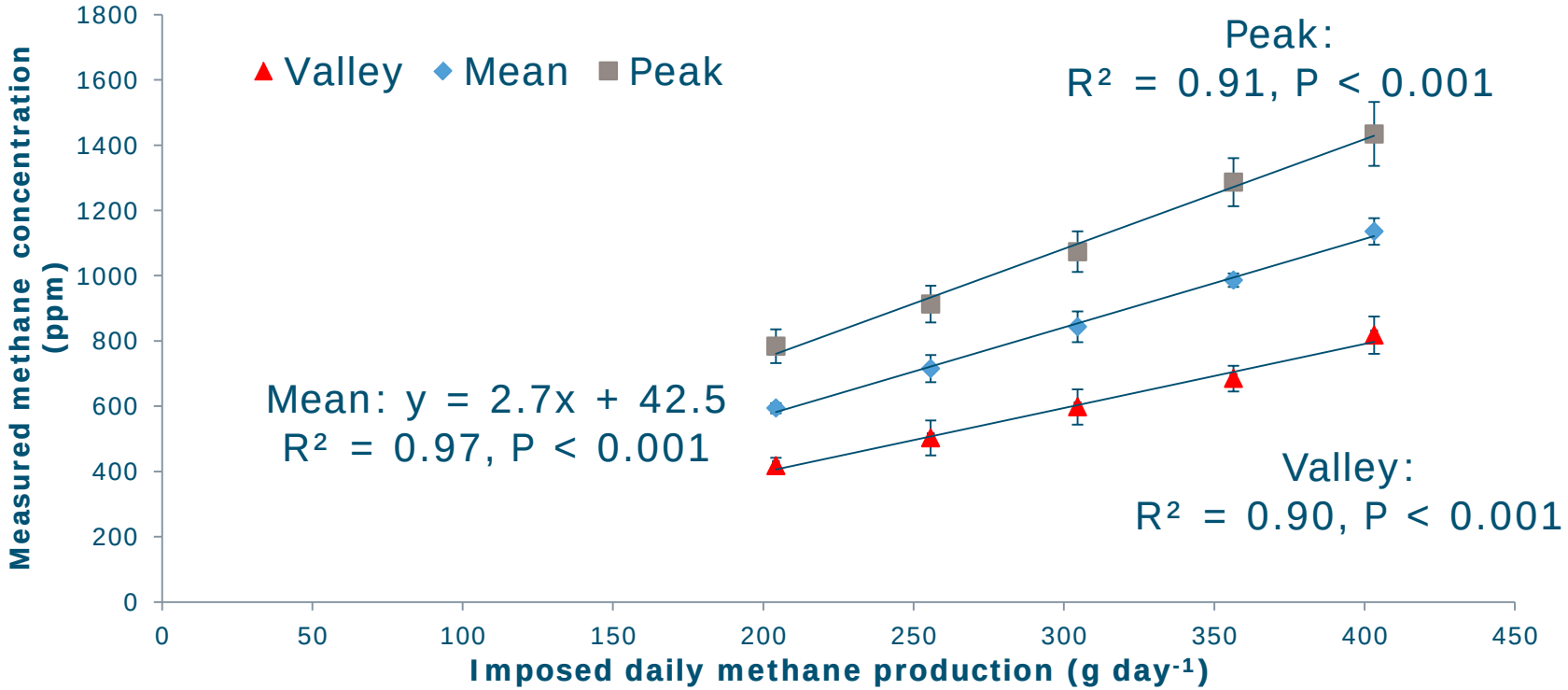
Results and discussion

- Measured mean, peak, and valley methane concentration versus methane production rates



- Strong linear relation between methane concentration and flux.

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Results and discussion

- Measured methane concentration versus predicted results

Imposed daily methane production (g day^{-1})	Methane conc. Measured at 5 cm from the nose (ppm)	Methane conc. Predicted at outlet of the nose (ppm)	Dilution factor (%)
	Mean (SD)	Mean (SD)	
200	594.1 (15.7)	695.4 (1.7)	14.6
250	714.9 (41.6)	859.5 (2.4)	16.8
300	843.3 (47.0)	1036.9 (0.7)	18.7
350	986.3 (20.3)	1214.2 (1.6)	18.8
400	1135.3 (40.7)	1363.0 (2.0)	16.7

- The dilution was stable between simulated cows

Conclusions

- Breath methane concentration measurements can predict methane production rates of cows under steady laboratory conditions.

- More validation work required under disturbed and varied circumstances (e.g. airflow pattern).

- The effect of the cow's head movement on results should also be further investigated.

Thanks!

Now
I know
how much
methane
I produce!

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